Egg production rates of *Pseudocalanus mimus* and *Pseudocalanus newmanii* in the Gulf of Alaska

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Highlights

Copepods are the essential linkages between phytoplankton production and fish in marine ecosystems. Numerically, the abundance of *Pseudocalanus* in the Gulf of Alaska is only exceeded by *Oithona similis*, but owing to its larger size, the majority of the year-round copepod production is likely contributed by *Pseudocalanus* species. In order to better understand their importance, egg production rates of the two dominant *Pseudocalanus* species in the Gulf of Alaska were examined over 2001 and 2002. Both average clutch size and female length varied seasonally in both species, with peaks in May during the spring phytoplankton bloom. During May clutches averaged 30-40 eggs (~60-90% of the female's weight), compared to seasonal means of 15-18 eggs (~45% of the female's weight). Yet, from May through October, daily specific egg production rates remained relatively constant at 10-16% for *P. mimus* and 10-20% for *P. newmanii*. Although clutch size suggests production should be highest in May, the impact of subsequently smaller clutches were offset by a greater percentage of females producing clutches on a daily basis. It appears that higher summer/fall temperatures resulted in shorter egg carrying times and hence a higher clutch turnover rate. As water cooled, and chlorophyll dropped, daily specific egg production rates fell to only few percent over the winter and into early spring.

The Problem:

Although *Pseudocalanus* carries its eggs attached to the female, they are usually dislodged during the collection by plankton nets, and scattered loose into the sample. Loose eggs can no longer be attributed to the species that produces them. Thus to determine egg production, one still requires the incubation of females to determine the clutch size and rate of egg production. Egg carriers typically produce smaller and less frequent clutches than egg scattering species, thus production is best followed over several days.

Methods:

Experiments were run during the GoA LTOP cruises at Stations Gak1, 4, 9, 13 and PWS2 (Figure 1). Females were collected during daylight with a 64 µm ring net fished slowly through the upper 50 m. Females were sorted immediately, and placed individually in 70 ml polystyrene tissue culture plates. From 40-100 females of *Pseudocalanus* spp. were setup, maintained at constant ambient sea-surface temperature under natural lighting cycles, and checked for the presence of an egg sac every 24 hours for 3 days. When eggs were observed the female was removed by pipette and preserved along with the attached egg sac for later identification to species and measurement and enumeration of the eggs.

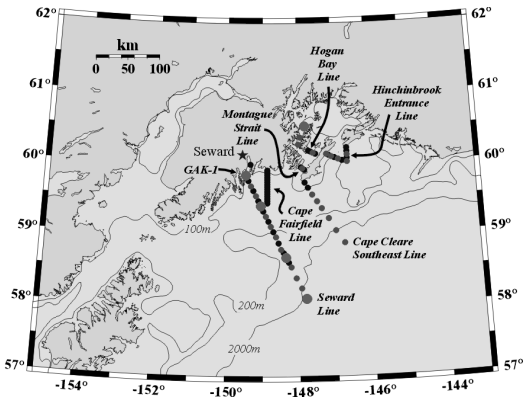

Figure 1. LTOP sampling area. Typical experimental sites indicated in purple

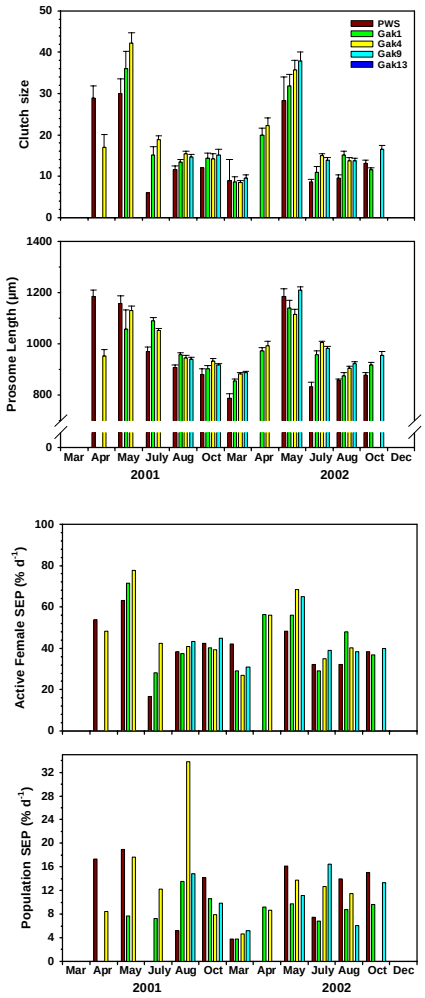

Figure 2. *Pseudocalanus mimus* body and clutch size increases from lows in March to maximums in May during the phytoplankton Spring Bloom. Increase in female size, explains some of this increase in clutch size (i.e. bigger females have bigger clutches). Although individual females have highest production in May, warmer temperature in summer stabilize production for the remainder of the year.

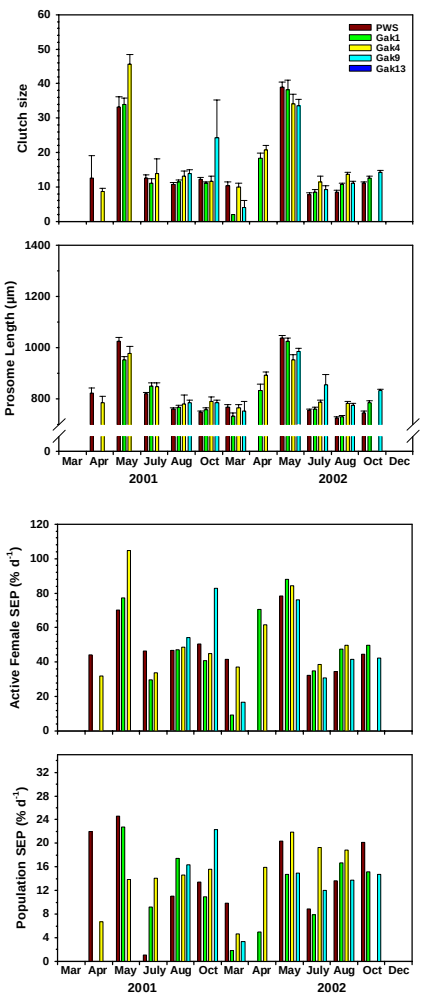

Figure 3. *Pseudocalanus newmanii* displays the same production patterns as *Pseudocalanus mimus*, but produces smaller clutches due to its smaller body size. Active SEP is similar between the 2 species, but *P. newmanii* populations generally have higher SEP than *P. mimus*.